PARALYSIS OF THE FACIAL NERVE DUE TO THE EUSTACHIAN ELECTRO-BOUGIE: REPORT OF A CASE.

By John B. Solley, M.D.,
FELLOW OF THE ACADEMY OF MEDICINE, NEW YORK.

A review of the literature of electrolytic dilatation of the Eustachian tube, appearing subsequent to Duel's publication of a new method in 1897[1] and his later reports of cases[2] and results,[3] has failed to reveal an accident similar to the subject of this paper. Nor has any mention been made of the possibility of such a complication in any of the various reports, special text-books on the ear, or in the published transactions of otological sections or societies which have been accessible. The accidents which have been experienced thus far in the procedure have been promptly ventilated, however, in the discussions of otological meetings, and by several of the few authors who have taken issue upon the method. Furthermore, in 1903 Dr. Duel asked by letter for reports upon the results of the method, if used, from some two hundred and fifty otologists, and published the information obtained.[4] He also recently informed me that he had not heard of such a case.

Symptoms referable to irritation of the chorda tympani have been met with in a few instances. I have had two such cases, but as the lesion is distinct from the injury of the main trunk of the facial to be described, it will be reserved for a future report dealing with an experience of over two years with the method.

E. S. F., aged forty years, married, a broker, came under treatment on February 17, 1905. At that time I had employed the method, as elaborated by Dr. Duel, in some fifty selected cases in the aural clinic of Dr. Dench at the New York Eye and Ear Infirmary, and in private practice, with very favorable results, and without accidents other than the temporary irritation of the chorda tympani mentioned. The patient's family history was distinctly neurotic, but otherwise good. His personal history was negative for tuberculosis, syphilis, gout, influenza, autotoxic or infectious arthritis. He was supposed to have had smallpox when ten days old. After an attack of scarlatina in childhood, the date of which is not recalled, he distinctly remembers having the right ear syringed for some days. He had measles at sixteen;

---

[1] On a New Method of Dilating Strictures of the Eustachian Tube by Means of the Galvanic Current, N. Y. Med. Jour., January 16, 1897.

[2] The Rapid Dilatation of Strictures of the Eustachian Tube by Electrolysis, New York Eye and Ear Infirmary Reports, 1897, vol. vii.

[3] The Value of Electrolytic Dilatation of the Eustachian Tube in Chronic Tubal Catarrh and Chronic Catarrhal Otitis Media, Amer. Jour. Med. Sci., 1900, p. 426.

[4] The Possibilities and Limitations of the Electro-bougie in the Treatment of Chronic Catarrhal Otitis, The Laryngoscope, 1903, p. 522.

otherwise no serious illness, and never any other acute inflammation of the ears. Impairment of hearing, accompanied by tinnitus in both ears, was first recognized twenty-one years ago. Inflation produced no improvement. Ten years ago ossiculectomy was performed on the right ear, relieving the tinnitus and improving the hearing temporarily. Vibratory treatment and inflation were tried four years ago without benefit. Two years ago the hearing and general health became so impaired that the patient was obliged to give up his work, and went abroad to consult foreign otologists. Vibratory treatment was advised and given by a distinguished Münich otologist, and the tubes bougied by the ordinary method, but without appreciable effect upon the hearing or tinnitus. One year ago the tubes were bougied in the usual manner in this country and were declared to be open. Since then the patient has not been under treatment.

Examination. The patient is of a highly nervous temperament; well nourished but pale. Hemoglobin (Fleischl), 80 per cent. Otherwise the general condition shows nothing significant. Mucous membranes of nose and throat congested and hypertrophic. Eustachian eminences spongy and congested. *Right Ear:* Drum thickened by irregular deposits; the tube is patent. Tone-limits, 2048–128. Bone-conduction normal. Watch not heard. Whisper (forced): sibilants at one foot, aspirates at four inches. *Left Ear:* Drum retracted and dull. Light-reflex contracted. Process of malleus prominent. Weber increased, Rinne negative, Swabach lengthened. Tone-limits, 2048–128. Watch not heard. Whisper (forced): sibilants at eighteen inches, aspirates at one foot. Tube admits very little air on inflation.

A medium-sized gold electro-bougie (Duel-Meyrowitz) was, therefore, passed into the left tube under the usual precautions, and 1 milliampère of current admitted from a thirty-cell dry battery. The bougie advanced readily through the membranous portion, but met with some resistance in the bony canal. The latter resistance was fairly uniform, yielding gradually, until the bougie had reached a point one and one-half inches from the pharyngeal opening. It then impinged against what felt like a firm, fibrous constriction. Steady but gentle pressure with 1.5 milliampères of current failed to overcome the obstruction at the end of five minutes, so the attempt was discontinued and the bougie slowly withdrawn. The discomfort of the operation and the crackling sounds experienced in the bony canal were slight. The hyperemic reaction of the drum was not unusual. The hearing remained unchanged. The patient was advised in regard to nasal spray, hygiene of the nose, throat, and teeth, hemic tonic, and general hygiene, and recommended to return on the third day for inflation. He was unable, however, to do so until one week later.

On February 25, the smallest bougie was passed easily, with

1 milliampère of current, to the constriction, one and one-half inches from the mouth of the tube. As the stricture did not differ essentially in situation and feel from many others met with, and furthermore corresponded with the conclusions reached by Bryant[5] in regard to fibrous constrictions, no unusal apprehension was felt in attempting to overcome it under the rigid precautions necessary in view of the proximity of the chorda tympani, the tympanic membrane, and the facial nerve. Firm, gentle pressure was maintained and at the end of a minute the current was increased to 1.5 milliampères. The crackling and the discomfort from the pressure were slight. In about another minute the bougie suddenly advanced about an eighth of an inch and met a firmer resistance, accompanied by sharp pain. The bougie was at once withdrawn one quarter of an inch, when on looking at the patient's face the entire left side was seen to be relaxed. Treatment was immediately discontinued. The left eye could be opened slightly; control of the other muscles on that side of the face was lost. Pain subsequent to the accident was slight and of short duration. The usual amount of hyperemia of the drum was present. On testing the hearing: sibilants were audible at three feet, aspirates at two feet, a gain of eighteen and twelve inches respectively. In about fifteen minutes the left eye could be opened wider and the eyebrow raised slightly. As the prognosis for the paralysis and the hearing was favorable the patient was reassured, especially as he was aware of an immediate diminution in the feeling of stuffiness in the ear and of an increase in the hearing.

February 27th. Paralysis still marked. Hearing unchanged. Tubes were inflated, and, as on all previous and subsequent visits, the mouths of the tubes were swabbed with adrenalin before, and with silver nitrate after the inflation.

March 4th. Paralysis less marked. Tube more open. Hears watch for the first time at one-half inch; sibilants at three and one-half feet, aspirates at two feet.

18th. Marked increase in the tone of all the left facial muscles, except the levator palpebræ superioris. Galvanic current applied over left side of face and forehead. Tubes inflated.

25th. Slight droop of the upper eyelid and of the left corner of the mouth, otherwise the flattening of the face has disappeared. Galvanism to face. Tubes inflated.

April 1st. Ptosis very slight. Tube is open. Hears sibilants at six feet, aspirates at two feet. Galvanism to face.

8th. No evidence of paralysis except sluggish contraction of levator palpebræ superioris in looking up. Tube inflated. Galvanism to face.

15th. Before inflation hears sibilants at six feet, aspirates at two feet; after inflation, sibilants at twelve feet, aspirates at four feet. Galvanism to face.

22d. Has had sore throat for several days. Mucus in left tube on inflation. Hears: before inflation, sibilants at eight feet, aspirates at three feet; after inflation, sibilants at twenty-five feet, aspirates at ten feet. Galvanism to face (last treatment).

From April 25 to July 28 the patient was obliged to be away on business and was seen only three times. During this interval he had several slight colds, the ear had felt stuffy, and the hearing had diminished. On the three occasions when seen inflation was not free, but as the case could not be followed closely bougieing was contraindicated.

On July 28 sibilants were heard at six feet, aspirates at three feet. Inflation was not free. A medium-sized bougie was accordingly passed with 1 milliampère of current, and advanced one and three-eighths inches from the mouth of the tube. The membranous portion was felt to be congested, but yielded gradually to slow and gentle ironing. The bony canal presented markedly less resistance than when first bougied on February 17. There was but little discomfort, although the patient became very apprehensive as the bougie entered the bony canal and the crackling began. The reaction was slight. The sense of fulness in the ear was at once relieved, but the hearing remained unchanged. In the following months the patient was again called away and was not seen until October 16, when the tube was found to be more open. Sibilants were heard at ten feet, aspirates at four feet. Another interval occurred on November 3, when the left drum was found to be reddened along the long process of the malleus and Schrapnell's membrane. When seen again on December 23, the redness had disappeared, but the tube was closed.

December 27th. Hearing before inflation: sibilants at eighteen feet, aspirates at four feet. After applying adrenalin to the mouth of the tube inflation was free. Sibilants were then audible at twenty-five feet, aspirates at eight feet.

30th. Before inflation hears sibilants at twenty-five feet, aspirates at ten feet; after inflation, sibilants at thirty feet, aspirates at twenty-three feet. The watch is audible at one inch. Tone-limits, 2048–26.

From December 30 to January 19, the date of last visit, the patient has been seen at regular intervals. Aspirates were heard at twenty-five feet, and the tube has remained open.

During the eleven months which have elapsed since the injury, the hearing has, therefore, increased for the whispered voice (not forced) from less than one foot to over twenty-five feet. The only evidence of the paralysis remaining is purely subjective, the patient stating that the left eye "waters" more easily than the right. In this period the patient has been seen and treated twenty-five times and the tube bougied three times.

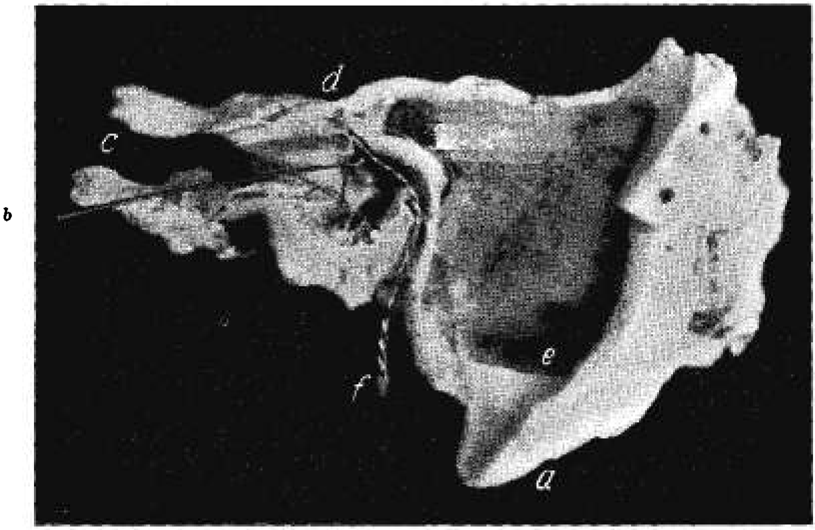
It is beyond the scope of this paper to enter into a purely theoretical discussion of the possibilities which might be brought forward to explain this rare accident. The part played by individual predisposition and by the electricity in the production of the paralysis are questions too subtle for accurate determination. Such factors are, moreover, regarded as of little moment, even as contributing causes, in comparison with the mechanical forces, and the anatomical relations of the parts. A study of the gross anatomy of the Eustachian tube and the middle ear in fresh specimens and the skeletal preparations in the laboratory of the New York Eye and Ear Infirmary discloses anomalous conditions in a percentage of cases that can readily be made to explain this lesion.

In many fresh specimens the thin, curved lamina of bone forming the outer wall of the aqueductus Fallopii, situated above the fenestra ovalis and between it and the tegmen tympani on the inner wall of the tympanic cavity, is partially or entirely defective. This thin plate of bone is the only covering of the facial nerve as it passes through the inner wall of the tympanic cavity (second part of the nerve beyond the genu externum), except for the lining membrane of the tympanum and the nerve sheath. In quite a few of the specimens the ostium tympanicum was also found at an abnormally high level on the anterior wall of the tympanum (5 to 7 mm. instead of the normal 4 mm. above the lowest point on the floor). Thickening and unusual prominence of the upper part of the ostium (processus cochleariformis) was noted, which would obstruct the passage of the bougie into the tympanic cavity. The latter observation is of especial interest in connection with the studies of Bryant,[1] whereby it was demonstrated that strictures of the tube, when present, are more frequently met with at the openings of the tube than elsewhere. Such an obstruction yielding suddenly to pressure would allow the bougie to be advanced sharply and forcibly against the ridge of the aqueduct of Fallopius on the inner wall of the tympanum, provided that the ostium were abnormally high or that the aqueduct were unusually prominent in the second part of its course. Under normal conditions—as it can be demonstrated on anatomical specimens—the bougie on entering the tympanic cavity passes upward, outward, and backward at a very acute angle, or even parallel, to the ridge of the aqueductus Fallopii. Even when it impinges against the latter it is in the nature of a glancing blow. Given, however, a Eustachian tube actually shorter than the average (less than one and one-half inches), or admitting the tip of the silver catheter an eighth of an inch or more farther than usual, in connection with a fibrous or bony obstruction at the ostium tympanicum; or presupposing the latter opening to be at an abnormally high level; if the facial nerve is exposed by defective bony covering, with or without the dangerous proximity to the ostium produced by unusual prominence of the aqueductus Fallopii, the electro-bougie, on suddenly overcoming the obstruction at the ostium, may be driven against the facial nerve and bruise or crush it against the inner wall of the aqueduct, at a distance of one and one-half inches or more from the pharyngeal opening of the tube. In the accompanying illustration the bougie lies in the bony canal and strikes the facial (silk thread) at nearly a right angle.

---

[1] Stricture of the Eustachian Tube in Aural Diseases and its Treatment. Annals of Otol., Rhin., and Laryng., June, 1905

The practial lesson of the case is obvious, even though the anatomical peculiarities cited are less frequent than would appear from the specimens studied. It is of great importance for the physician and patient to be prepared for such a contingency, the bearing of which is immediate with reference to proper warning to the patient and careful technique, and remote in regard to serious permanent damage and ensuing medico-legal complications. In view, however, of the favorable prognosis and rarity of the lesion, and the great benefit to be derived and confidently expected, in the majority of such cases of impaired hearing, from the proper use of the electro-bougie, the possibility of such an accident does not form a serious objection, in my opinion, to this method of Eustachian dilatation.



a. Mastoid process. *b*. Bougie in the bony portion of Eustachian tube (part of wall removed by section). *c*. Carotid canal. *d*. Tegmen tympani. *e*. Mastoid cavity (cells removed). . Silk thread representing the course of the facial nerve through the aqueductus Fallopii.